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Screening of different Rice entries against Rice Gall Midge, *Orseolia oryzae* (Wood-Mason)

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***Abstract*—*In order to develop rice cultivars for resistance to the gall midge, Orseolia oryzae (Wood-Mason), some rice entries were screened under natural field conditions at the Chiplima, OUAT, Odisha under All India Coordinated Rice Improvement Project during kharif 2016. Gall midge incidence as silver shoot was recorded on 30 and 50 days after transplanting and scoring was done. Highest incidence of silver shoot was recorded in TN-1 (36.71% SS after 50 DAT) whereas 12 entries viz., W 1263, INRC 3021, Sudu Hondarawala, PTB 26, RP 4686-48-1-937, RMSG-11, WGL 1147, WGL 1127, WGL 1121, WGL 1131, WGL 1141, JGL 27058 were found resistant to gall midge damage. Based on the reaction of the different entries the presence of biotype 1 was identified.*

***Keywords*— Gall midge, Chiplima, rice entries, screening, field.**

I. INTRODUCTION

Rice is the most important cereal food crop of India covering about one-fourth of the total cropped area and providing food to about half of the Indian population. Introduction and wide adoption of high yielding varieties has led to severe incidence of different insect pests. Nearly 300 species of insect pests attack the rice crop at different stages and among them only 23 species cause notable damage [6]. Among them, Asian rice gall midge (GM), *Orseolia oryzae* (Wood-Mason) is one of the important insect which has been prevalent in almost all the rice growing states in India except the Western Uttar Pradesh, Uttaranchal, Punjab, Haryana and Hill states of Himachal Pradesh and Jammu and Kashmir [1]. GM causes an annual yield loss of 0.8% of the total production, amounting to US$80 million [5]. This is essentially a monsoon pest and causes damage wherever high humidity and moderate temperature prevail, even in dry seasons [3]. The external symptom of damage caused by gall midge is the production of a silvery-white, tubular leaf sheath gall called a *silver shoot* or *onion shoot*. This is due to the feeding and salivary secretion by the larvae which turn the growing shoot meristem into a gall [7]. This renders the tiller sterile and do not bear panicle [9]. Many management strategies viz., chemical, cultural, biological and planting of resistant cultivars that have resistance to insects are employed to reduce the damage caused by this insect-pest. Among them, the use of resistant rice varieties appears to offer the most effective component for incorporation into an integrated pest management strategy [11]. For this, breeding resistant varieties has been a viable, ecologically acceptable approach for managing this pest [5].

II. MATERIALS AND METHODS

The experiment was conducted in the experimental farm of Regional Research and Technology Transfer Station (OUAT), Chiplima, Sambalpur, Odisha, during *kharif*, 2016. The Station is situated at $20^{0}21'$ N latitude and $80^{0}55'$E longitude in Dhankauda block of Sambalpur district at an altitude of 178.8 m above MSL. The climate of the area is warm/sub humid. Nursery of different rice entries were sown in the July and transplanting was done after 25 days of sowing at 15 cm x 15 cm hill spacing. All the agronomic practices were followed during crop growth period. Gall midge incidence as silver shoot was recorded on 30 and 50 days after transplanting and then percentage of silver shoot was worked out. The pest intensity was scored as per standard evaluation system, IRRI for gall midge.

Table.1: Standard evaluation system for rice gall midge

Scale	Damage (%)	Reaction
0	No damage	HR
1	<1%	R
3	1-5%	MR
5	6-10%	MS
7	11-25%	S
9	>25%	HS

III. RESULTS AND DISCUSSION

Rice gall midge is one of the major pestsof rice in Hirakud command area, Sambalpur, Odisha. Different rice entries obtained from ICAR-IIRR, Hyderabad were evaluated to

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find out the field resistance against rice gall midge. Rice gall midge is one of the major and regular pests of rice in Hirakud command area, Sambalpur, Odisha. The Sambalpur district in the west-central table land zone of Odisha is also considered to be the endemic pocket for gall midge in the state [2]. Different rice entries obtained from ICAR-IIRR, Hyderabad were evaluated to find out the field resistance against rice gall midge.

Among 164 entries screened against gall midge, the entries viz., W 1263, INRC 3021, Sudu Hondarawala, PTB 26, RP 4686-48-1-937, RMSG-11, WGL 1147, WGL 1127, WGL 1121, WGL 1131, WGL 1141, JGL 27058 were found resistant to gall midge damage. The entries viz., KAVYA, Aganni, INRC 15888, KAKAI (K 1417), SINNA SIVAPPU, PTB 12, PTB 32, TH BR 68, TH BR 69, TH BR 70, TH BR 71, TH BR 72, TH BR 74, TH BR 79, RMSG-7, RMSG-10, RP 5925-24, WGL 1143, WGL 1144, WGL 1145, WGL 1146, WGL 1118, WGL 1119, RP 2068-18-3-5, JGL 21789, JGL 21831, JGL 25154, JGL 25969, JGL 27015, JGL 27020, JGL 27056, JGL 27075, JGL 27361, JGL 27371, KNM 1592, KNM 1598, KNM 1621, KNM 2251, KNM 2275, KNM 2266, KNM 13595, KNM 1623, KNM 1638, JGL 3828, and WGL 505 were found to be moderately resistant to gall midge incidence. The entries viz., Phalguna, Dukong 1, RP 2333-156-8, Abhaya, CAUR-1, RP5923, COGR-2, IC 462362, IC 577588, ACC 4740, ACC 5403, IC 576897, IC 577224, IIRR-Bio-SB-6, ARC 15570C, VELLAI ILANKALAYAN, WGL32100, JGL 24520, JGL 25947, JGL 25960, JGL 25964, JGL 26989, JGL 27072, KNM 1717, KNM 1728, WGL 667, WGL 705, WGL 767 and TN 1 were found highly susceptible and the remaining entries were found susceptible to gall midge damage. Based on the reaction pattern of resistant-susceptible-susceptible (R-S-S) the prevalence of biotype 1 was identified at Sambalpur.

Table.2: Reaction of different rice entries against rice gall midge

Entry No.	Name of entry	Silver shoot (SS)		Reaction
		30 DAT	50 DAT	
1	KAVYA	1.37	1.96	MR
2	W 1263	0.57	0.00	R
3	ARC 6605	3.92	7.04	MS
4	PHALGUNA	15.23	32.03	HS
5	ARC 5984	6.11	18.08	S
6	DUKONG 1	13.10	35.48	HS
7	RP 2333-156-8	15.00	25.87	HS
8	MADHURI L 9	2.50	5.71	MS
9	BG 380-2	16.55	27.70	HS
10	MR 1523	12.12	25.00	S
11	RP 2068-18-3-5	6.54	13.79	S
12	ABHAYA	16.50	31.02	HS
13	INRC 3021	0.50	0.00	R
14	AGANNI	0.00	1.21	MR
15	INRC 15888	1.84	2.36	MR
16	B 95-1	6.63	2.90	MS
17	TN1	17.62	36.71	HS
18	CAUR-1	31.16	39.74	HS
19	RP5923	30.84	43.48	HS
20	COGR-2	25.17	31.87	HS
21	IC 462248	17.12	16.00	S
22	IC 462362	46.15	46.36	HS
23	IC 463334	12.41	1.34	S
24	IC 463414	17.33	19.05	S
25	IC 463393	14.10	19.14	S
26	IC 462447	18.32	14.81	S

27	IC 463987	21.99	14.67	S
28	IC 577588	28.66	50.00	HS
29	ACC 3643	18.92	13.64	S
30	ACC 4656	13.48	15.98	S
31	ACC 4740	41.62	34.54	HS
32	ACC 5403	33.77	37.35	HS
33	IC 545528	16.18	20.74	S
34	IC 576897	26.72	38.58	HS
35	IC 462336	21.38	16.40	S
36	IC 545441	20.42	16.22	S
37	IC 459646	14.39	11.18	S
38	IC 450029	20.23	10.61	S
39	IC 462336	19.12	19.40	S
40	IC 577224	48.78	43.27	HS
41	IC 466408	14.38	6.99	MS
42	IIRR-Bio-SB-6	47.67	30.84	HS
43	AC 4236	17.16	7.14	S
44	ARC 10676	21.53	3.87	S
45	ARC 10840	17.19	20.16	S
46	ARC 11220	12.82	15.85	S
47	ARC 11281	20.11	17.46	S
48	ARC 14636	19.28	19.77	S
49	ARC 14771	25.73	17.39	S
50	ARC 15570C	25.74	37.91	HS
51	ARC 5754	14.93	18.71	S
52	ARC 5956	14.53	7.03	S
53	ARC 5981	9.83	17.65	S
54	ASD 7	9.20	3.88	MS
55	KAKAI (K 1417)	2.21	0.71	MR
56	SINNA SIVAPPU	2.10	0.00	MR
57	SUDU HONDARAWALA	1.09	0.00	R
58	PTB 12	3.10	0.80	MR
59	VELLAI ILANKALAYAN	26.42	25.42	HS
60	ARC 6248	11.30	20.62	S
61	CVL (CHINA)	4.32	8.39	MS
62	ARC 6031-B	6.90	1.57	MS
63	PTB 26	0.66	0.74	R
64	PTB 32	3.73	0.00	MR
65	IC 332045	11.73	1.55	S
66	IC 466451	7.87	0.00	MS
67	TH BR 68	2.48	0.68	MR
68	TH BR 69	0.72	1.77	MR
69	TH BR 70	4.11	0.00	MR
70	TH BR 71	3.55	0.00	MR
71	TH BR 72	3.83	0.00	MR
72	TH BR 74	5.48	0.82	MR
73	TH BR 79	5.77	3.85	MR

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74	RP4686-48-1-937	0.60	0.00	R
75	RMSG-2	13.69	15.75	S
76	RMSG-5	20.61	22.47	S
77	RMSG-6	6.90	7.58	MS
78	RMSG-7	2.03	0.60	MR
79	RMSG-10	1.37	0.00	MR
80	RMSG-11	1.08	0.00	R
81	RP 5925-24	1.55	0.00	MR
82	WGL 1143	1.44	0.83	MR
83	WGL 1144	1.80	0.00	MR
84	WGL 1145	1.28	0.00	MR
85	WGL 1146	1.12	0.00	MR
86	WGL 1147	0.00	0.72	R
87	WGL1118	1.29	0.00	MR
88	WGL1119	1.69	0.00	MR
89	WGL1121	0.00	0.00	HR
90	WGL1127	0.47	0.00	R
91	WGL1131	1.12	0.00	R
92	WGL1141	1.10	0.00	R
93	Tellahamsa	21.08	12.42	S
94	WGL32100	32.94	19.23	HS
95	RP1	7.14	0.76	MS
100	RP5587-B-B-B-32	23.87	15.38	S
101	RP 2068-18-3-5	2.14	0.00	MR
102	JGL 20644	7.95	20	S
103	JGL 21789	2.84	4.20	MR
104	JGL 21831	3.94	4.88	MR
105	JGL 24344	7.38	15.95	S
106	JGL 24520	27.27	37.59	HS
107	JGL 25154	0.72	2.38	MR
108	JGL 25925	3.05	12.93	S
109	JGL 25947	17.39	44.03	HS
110	JGL 25958	13.70	21.69	S
111	JGL 25960	20.11	40.56	HS
112	JGL 25964	15.43	40.61	HS
113	JGL 25969	5.13	4.86	MR
114	JGL 25975	13.33	17.17	S
115	JGL 25998	10.28	23.53	S
116	JGL 26772	4.32	9.35	MS
117	JGL 26960	11.34	21.60	S
118	JGL 26989	18.01	48.57	HS
119	JGL 27015	1.17	3.01	MR
120	JGL 27020	2.53	0.74	MR
121	JGL 27056	1.79	4.76	MR
122	JGL 27058	0.00	0.83	R
123	JGL 27063	1.76	7.63	MS
124	JGL 27072	13.04	35.76	HS

125	JGL 27075	4.47	3.76	MR
126	JGL 27143	5.38	24.38	S
127	JGL 27353	6.56	6.29	MS
128	JGL 27356	2.72	5.92	MS
129	JGL 27361	2.72	2.91	MR
130	JGL 27371	0.00	1.63	MR
131	JGL 27391	11.59	25.00	S
132	KNM 1592	0.66	4.07	MR
133	KNM1598	1.23	4.14	MR
134	KNM 1600	2.50	6.21	MS
135	KNM 1610	4.60	10.06	MS
136	KNM 1638	4.62	8.90	MS
137	KNM 1616	3.29	8.61	MS
138	KNM 1621	3.92	4.39	MR
139	KNM 1625	1.72	6.47	MS
140	KNM 1632	1.23	8.39	MS
141	KNM 1717	19.12	44.44	HS
142	KNM 1722	1.32	5.66	MS
143	KNM1724	0.67	7.50	MS
144	KNM1728	7.14	25.55	HS
145	KNM 1730	10.81	17.69	S
146	KNM 2213	11.92	24.14	S
147	KNM 2251	3.21	5.04	MR
148	KNM 2275	2.16	0.00	MR
149	KNM 2266	2.65	4.03	MR
150	JGL 13595	0.00	1.64	MR
151	JGL 3828	0.68	4.92	MR
152	KNM 1623	2.31	4.93	MR
153	KNM 1638	4.35	2.61	MR
154	WGL-401	1.29	5.76	MS
155	WGL-505	1.84	3.27	MR
156	WGL-667	28.77	35.41	HS
157	WGL-705	27.39	50.63	HS
158	WGL-767	16.38	34.09	HS
159	WGL-810	15.32	16.23	S
160	WGL-819	13.13	9.68	MS
161	WGL-825	14.39	8.11	MS
162	WGL-938	16.15	4.60	S
163	WGL-1062*	13.29	5.95	S
164	JGL1118	14.02	2.63	S

R–Resistant, MS–Moderately susceptible, S–Susceptible, HS–Highly susceptible

After extensive testing of host-plant differentials it is found that biotype 1 cannot damage entries containing resistance genes derived from either Eswarakora or Siam 29, biotype 2 can damage the Eswarakora group but is unable to damage the Siam 29 group, whereas biotype 3 can damage the Siam 29 group but not the Eswarakora group [4]. Although geographic distributions of different gall midge biotypes is complex. After testing of different rice entries it is found that gall midge biotype 1 is present in Sambalpur. Previously it is also reported that populations of Hyderabad, Warangal, and Maruteru in Andhra Pradesh, Sambalpur in Odisha, and Raipur in Chhattisgarh qualified to be biotype 1, populations of Cuttack and Bhubaneswar in Odisha and at Mangalore in Karnataka, in Goa and at Sakoli in Maharashtra qualified to be biotype 2. GM populations at Ranchi in Bihar and Wangbal in Manipur had biotype 3 characteristics [4]. North coastal districts of Srikakulam and Vizianagaram in Andhra Pradesh and the Bhandara (Sakoli) region of Maharashtra qualified to be biotype 4 populations. Moncompu area of Kerala qualified to be biotype 5. In Manipur where biotype 3 had prevailed earlier another biotype emerged. The standard set of host-plant differentials confirmed the existence of yet another new biotype, designated as biotype 6 [7].

Many resistant and moderately resistant varieties are being cultivated by the farming community in Odisha to reduce gall midge damage considerably. These include Heera, Kalinga-II, Neela, Tara, Khandagiri, Udaya, Daya, Gouri, Pratap, Shakti, Phalguna, Meher, Birupa, Bhanja, Pratiksha and Samanta for medium lands and Samalei, Manika and Urbashi for lowlands [2]. Sumathi and Manickam, [10] tested different rice accession in field condition at Rice Research Station, Tirur, Tamilnadu during 2009 and found that the cultures viz., RP 4683-29-2-645, RP 4683-30-1-648, RP 4686-49-1- 943, RP 4687-52-2-1197, RP 4688-53-2-1258, RP 4688-53-2-1259, JGL 17025, JGL 17183, JGL 17187, JGL 17189, KAVYA, JGL 17190, JGL 17196, JGL 17198, JGL 17211 and JGL 17221 were recorded nil gall midge damage and found to be resistant in field screening.

IV. CONCLUSION

The genotypes W 1263, INRC 3021, Sudu Hondarawala, PTB 26, RP4686-48-1-937, RMSG-11, WGL 1147, WGL 1127, WGL 1121, WGL 1131, WGL 1141, JGL 27058 exhibited resistance against gall midge so, they can be developed as varieties or can be used in breeding programme as a source of gall midge resistance.

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